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BOOKS RECEIVED.

L'Année biologique. YVES DELAGE. Paris, Schleicher frères. 1899. Third year, 1896. Pp. xxxv + 841.
The Theory of Electrolytic Dissociation and some of its Applications. New York, The Macmillan Company. 1900. Pp. xii + 289. \$1.60.
The Psychology of Religion. EDWIN DILLER STARBUCK, with a preface by WILLIAM JAMES. London, Walter Scott; New York, Charles Scribner's Sons. 1900. Pp. xx + 423.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF BIOLOGY.

THE regular meeting was held on January 8, 1900, Professor F. S. Lee presiding.

Mr. David Griffiths spoke of the structure of certain species of the *Sordariaceæ* and briefly reviewed the work which has been done on the group. Certain species were taken as types of the principal genera, and their life history traced, *Sordaria finicola*, *Podospora coprophila*, *Hypocopra equorum* and *Sporormia intermedia* being spoken of especially. Some time was devoted to a discussion of the much mooted question of fertilization in this and kindred groups. The principal methods of spore distribution were outlined.

Dr. Wm. J. Gies reported upon the changes which may occur in lymph after the administration of protoplasmic poisons. Quinin did not interfere with the usual influence of dextrose although it did suppress the action of leech extract. The results with dextrose, therefore, indicate that the increase in the quantity of lymph following its injection in large quantity is due mainly to physical factors. In the case of leech extract, on the other hand, there is an interference with the action of the physiological factors that appear to be responsible for the changes usually brought about by this lymphagogue. That the increase in the amount of lymph after large quantities of dextrose have been injected is not due primarily to increased capillary pressure, as is held by Cohnstein and Starling, was shown in one of the experiments in which quinin caused the death of the animal, and yet from which the lymph continued to flow for three hours. After injecting arsenic, which is said to very greatly increase the permeability of the blood

vessels, especially those of the portal system, there was little in the flow and character of the lymph resembling the usual effect of lymphagogues. It appears, therefore, that Starling's hypothesis of increased capillary permeability does not fully account for the action of lymphagogues, and that the mechanical theory of lymph formation fails as long as it does not explain the most striking phenomena of the process—those following the injection of Heidenhain's lymphagogues or Asher's 'liver stimulants.' The physiological theories of Heidenhain and Asher would explain them.

Professor Frederic S. Lee said that the duration of the life of voluntary muscle in mammals after the death of the individual has not been well known. Under the author's direction, Messrs. Adler and Bulkley have been investigating this in cats and rabbits. In each experiment the animal was killed, a particular muscle was excised and stimulated by electric shocks at five-minute intervals, and the resulting contractions were recorded. The muscles used were the *soleus* (deep red), and the *tibialis anticus* (pale). Each survived several hours, the maximum for the red muscle being 14 hours and 37 minutes, and for the pale, 12 hours and 20 minutes. It is known that, in comparison with white muscle-fibres, red fibres contain relatively more sarcoplasm, which is nutritive in function, and relatively less fibrillar substance, which is the contractile part. This may perhaps account for the longer survival of the red muscle. So far no constant difference in duration has been observed between the cat and the rabbit. In both the red and the pale muscle the decrease of irritability was gradual, but occasionally in the *tibialis* there was a sudden fall at the end of about one hour, the irritability then continuing at a low ebb for hours but with a gradual decline. The sudden fall may have been due to the early death of the white fibres, which intermingled with red ones, occur in the pale muscle. Besides the theoretic interest, the above results have a practical bearing, since they show that mammalian muscle can readily be used for experimental purposes in the physiological laboratory. This is now being done at Columbia University.

Professor Henry F. Osborn reported upon

recent additions to the American Museum from the Cope collection through the munificence of President Jesup. (For a fuller account see SCIENCE, N. S., XI., p. 77.)

Bashford Dean described the condition in seven eggs of *Myxine glutinosa* which he had received from Professor A. E. Verrill. These had been collected in 1880 on the Newfoundland banks in water of 90 and 150 fathoms. The egg membranes were regarded as more specialized than those of *Bdellostoma*.

FRANCIS E. LLOYD.
Secretary.

DISCUSSION AND CORRESPONDENCE.

DO THE REACTIONS OF THE LOWER ANIMALS
AGAINST INJURY INDICATE PAIN SEN-
SATIONS?*

IN a posthumous article with the above title by the lamented Professor Norman is contained the chief substance of what was to have been his doctorate thesis. It comprises new facts and a statement of those that are old in a way which will interest especially the psychologists and gratify to no small degree the physiologists—or some of them. While the author answers the titular question in the negative, as his main thesis, 'lower animals' indicates for him only those species up to and including the flounder. Moreover, the paper is remarkably free from opinions based on analogy, the evidence being weighed as its author thinks solely for what it is worth and regarding the particular species experimented upon alone.

The report begins with a proper adverse criticism of that mode of argument in a circle which bases presumption as to the mode of consciousness concomitant to movements, on these same movements taken as expressive of certain modes of consciousness. He follows rather the purely physiological method of considering movements as the immediate consequence of physical stimulation, the psychic factor not entering the problem at all. Certain experiments seem to the author to prove the correctness of this point of view.

* By the late Professor W. W. Norman, University of Texas, with Additional Note by Jacques Loeb. *American Journal of Physiology*, Vol. III., No. VI., 1 Jan., 1900. Pp. 270-284.

The most striking and classic of these experiments were made on the common earthworm (*Allolobophora*). If such a low animal be divided at its middle transversely, only the posterior half shows those squirming and jerking movements which, anthropomorphically viewed, seem to indicate pain; the anterior half (containing the brain) crawls, as ordinarily, away. Now if each of these halves be halved, again the posterior segment of each squirms while the anterior halves crawl away. This same process may be continued with precisely like result until the pieces are no longer large enough to crawl independently. This striking phenomenon is explained in part by the two sets of muscular fibers in the worm, one longitudinal, causing the squirming and jerking, and the other circular, which produce the crawling. Why in the posterior segments the former set should be initially stimulated and in the anterior the latter set, Professor Norman says he does not know. For its purpose the experiment seems conclusive. Similarly, if a swimming leech be cut in two, both parts, after a pause, swim off as if nothing had happened. Like events take place with other species of worms, the anterior or brain part being regularly that undisturbed by the extraordinary stimulus.

The abdomen of a hermit crab may be cut in two without any 'but a very slight response' from any remaining movable organ. *Limulus* stops a few seconds when four or five abdominal segments are cut away, then proceeds quietly breathing as before. Its order of events is regularly: cessation of breathing, flexion of abdomen, pause, extension of abdomen, respiratory movements. *Geophilus* cut in two in the middle continues its crawling, the front half going forwards and the rear half backwards. Millipedes divided while walking do not hasten nor stop nor jerk. Dragon flies lose parts of their abdomens without any appreciable change in position. As was long ago pointed out, bees continue to eat when their abdomens are cut way during the process.

Lastly, sharks and flounders, provided a current of water circulate through their gills, will allow the most tedious and deep-going cutting operations on their heads without the slightest